

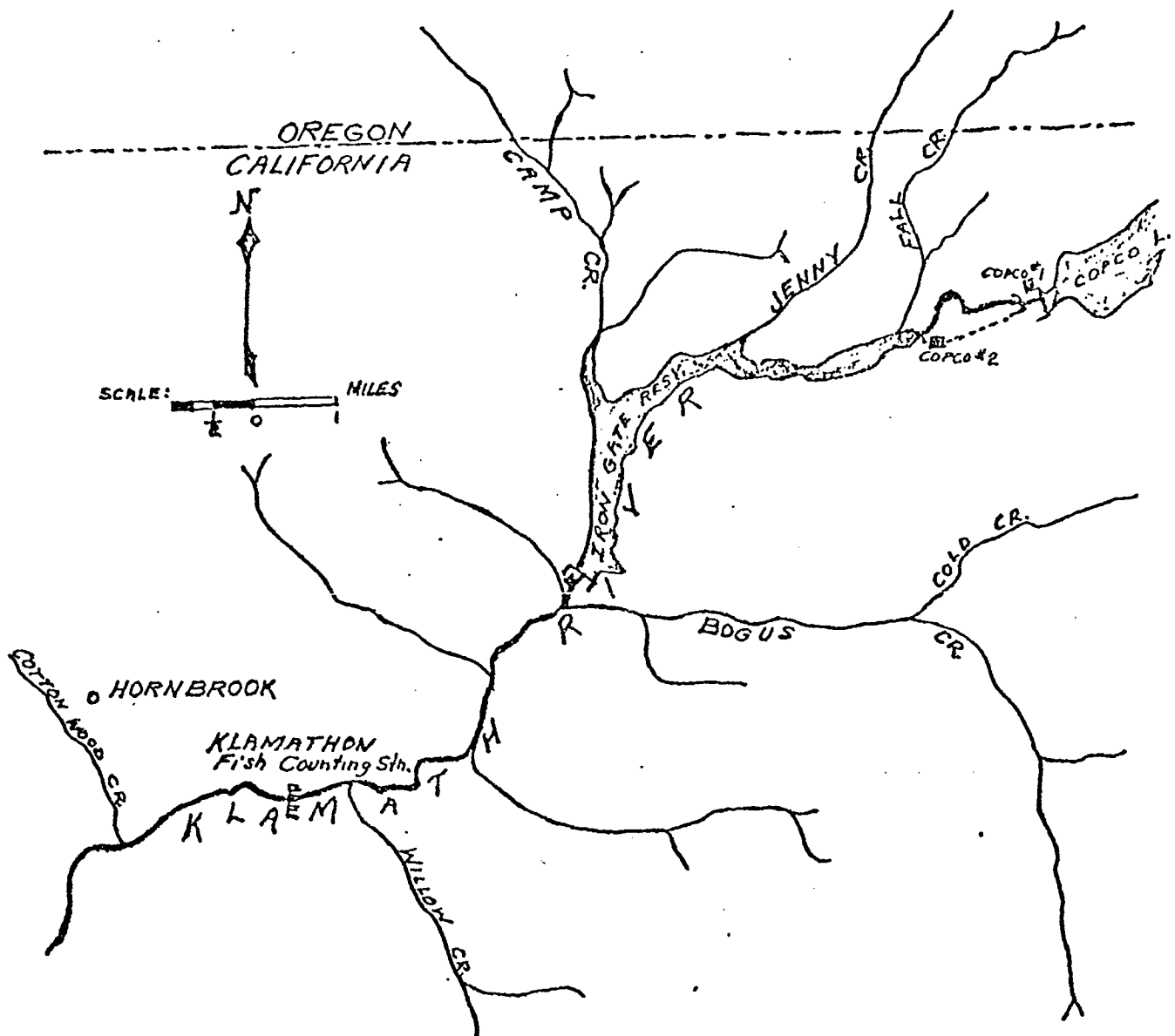
CASE STUDY #1  
IRON GATE DAM  
KLAMATH RIVER

I. Project Description

Iron Gate Dam was constructed on the Klamath River near Yreka, California in 1960 by the Pacific Power and Light Company. This project is part of a series of hydroelectric power facilities in the upper Klamath River basin. Its maximum storage capacity is 58,000 acre-feet with a surface area of 1,020 acres. The dam was constructed primarily to regulate flows from Copco Powerhouse #1 and #2 to reduce extreme in-stream flow fluctuations. Hydroelectric power is also produced. Approximately 8 miles upstream from Iron Gate Dam is Copco #2 dam and powerhouse facility and 1/4 mile farther upstream is Copco #1 dam and powerhouse (Figure 1). Copco #1 was put into operation in 1922 and Copco #2 was followed in 1925. Copco #1 has a storage capacity of 77,000 acre-feet and a maximum surface area of 1,700 acres while Copco #2 has a maximum capacity of 55 acre-feet and an area of 5 acres.

Iron Gate Dam became the uppermost limit of anadromous fish migration in the Klamath River (see Figure 1).

Figure 1  
LOCATION MAP  
UPPER KLAMATH RIVER



LEGEND

- [ DAM
- POWER HOUSE
- ≡ FISH COUNTING STATION

Source: California Department of Fish and Game, "Klamath River Stream File", 1975.

## II. Pre-Project Conditions

Upper Klamath Lake is connected by Link River to Lake Ewauna which is the headwaters of the Klamath River. There is no definite feature marking the beginning of the Klamath River except perhaps the dam at Keno, Oregon. In the 18 miles from Klamath Falls to Keno, the Klamath River meanders through flat swampy meadows until the river drops almost 1,500 feet in 30 miles to the Copco #1 powerhouse site.

River discharge at Copco Dam, during the 1924-50 period, varied between 527,000 and 1,895,000 acre-feet seasonally with an average seasonal discharge over that same period of 1,051,000 acre-feet. The maximum recorded flow, below Fall Creek near Copco #2, of 9,660 second-feet occurred April 27 and May 3, 1935; the minimum flow of 83 second-feet occurred on August 2, 1931, which was a result of Copco #1 peaking plant operations. Figure 2 represents the mean discharge pattern for the period of 1924-50. Stream flow conditions predating Copco were not found. During this time, flows generally responded to the winter rains, snowmelt in spring and a dry summer.

The Klamath River below Copco and prior to 1960 flowed unimpaired for approximately 200 miles to the Pacific Ocean. The principal tributaries of the Klamath River below the Copco are the Shasta, Scott, Salmon and Trinity Rivers. The main tributaries between Copco and Iron Gate are shown in Figure 1.

Table 1

CHINOOK SALMON COUNTS AND EGG TAKES AT KLAMATHON RACKS  
KLAMATH RIVER 1925-1961

<u>YEAR</u>	<u>NUMBER OF FISH COUNTED</u>	<u>NUMBER OF EGGS TAKEN</u>
1925	10,420	6,735,000
1926	9,387	18,042,000
1927	No Count	11,797,000
1928	No Count	4,621,000
1929	4,031	5,016,000
1930	2,392	3,103,000
1931	12,611	13,643,000
1932	13,740	4,035,000
1933	No Count	1,779,000 (a)
1934	10,340	6,316,000
1935	14,061	7,541,000
1936	10,398	3,349,000
1937	33,144	7,334,000
1938	16,340	7,629,700
1939	No Count	7,056,000
1940	14,965	8,414,000
1941	11,204	3,760,000 (a)
1942	13,038	3,643,000 (a)
1943	No Count	3,640,000 (a)
1944	No Count	3,383,000 (a)
1945	No Count	4,682,706 (a)
1946	No Count	4,302,560 (a)
1947	No Count	798,765 (a)
1948	5,821	--
1949	11,504	165,600 (a)
1950	21,584	665,000 (a)
1951	17,857	1,261,000 (a)
1952	6,591	1,422,000 (a)
1953	6,267	1,097,000 (a)
1954	2,042	202,000 (a)
1955	14,946	3,271,750 (a)
1956	6,770	1,553,600 (a)
1957	2,436	260,572 (a)
1958	1,950	21,250 (a)
1959	3,546	1,404,600 (a)
1960	6,353	--
1961	9,021	3,704,000 (a)

(a) Eggs taken at Fall Creek, others at Klamathon

Source: U. S. Senate Permanent Fact Finding Committee  
on Natural Resources, 1962.

In 1931 the California Department of Fish and Game completed a 5-year study of the Klamath River fishery. The following excerpts summarize their findings.

"The king salmon which is indigenous to Klamath River differs in size and certain anatomical characters from that of the Sacramento River.

"Two species, the king salmon and the silver salmon, are represented in sufficient numbers to be of commercial importance. The humpback and dog salmon are only occasionally seen. The redfish (sic) (Oncorhynchus nerka) is not found in the river.

"Two definite immigrations of king salmon have been observed, a spring and a summer run. The spring run is now so depleted as to be scarcely evident. The summer run is the only one of commercial importance.

"Depletion of Klamath salmon is not only apparent, but it seems to be progressing at an alarming rate. There is evidence also that artificial propagation alone is not able to cope with the situation.

"Gill net fishing at the mouth of the river is a deleterious straining process that permits the escape of small fish which later appear in ill-proportioned numbers on the spawning beds. If the tendency to mature early is inherited, the result may be weakening of the entire stock in so far as it is of commercial worth."

The Klamath River basin supports many species of game animals and birds. The upper Klamath basin marsh and waterway are vital to the maintenance of the waterfowl of the Pacific Flyway. Under natural conditions prior to the activities and influences of humans, these vast networks of tributary streams, lakes, marshes and wetland meadows provided nesting grounds for a multitude of waterfowl and shorebirds. Nesting populations were high, and in addition, a high percentage of the waterfowl population of the western portion of the continent passed through the area on spring and fall migrations.

The U. S. Fish and Wildlife Service in 1968 examined the fish and wildlife resources of the Klamath River basin. Their examination indicated that:

"Although some irrigation took place prior to 1900, substantial land use changes did not occur until the passage of the Reclamation Fund Act of June 17, 1902. Subsequently, marshes were drained, dikes and levees constructed, and almost complete control of the waters of the basin resulted. However, the agricultural development did not entirely displace waterfowl habitat. A great deal of the basin area has remained in pasture, or has been converted to grain production, and continues to support waterfowl use."

### III. Project Development

Prior to the construction of Iron Gate Dam upstream, electrical power facilities were controlled for peak power demands and each unit was operated in conjunction with the other. That is, power plants are operated at capacity during the day and are shut down at night and on weekends with short-term flow variations from 3,200 cfs to 200 cfs. These operations resulted in severe fluctuations in Klamath River flows which were hazardous to both fish and humans. Numerous complaints were made by downstream water users, and the Department of Fish and Game expressed concern about the effect of these fluctuations on the fish and wildlife resources. In the mid 1940's the California House of Representatives authorized (HR 162) a Public Utilities Commission investigation of the "reduction of Klamath River fluctuations at the Copco plants". The results

of this investigation were presented to the State Assembly Interim Committee on Fish and Game on December 10, 1947.

Their recommendations were:

"Based upon the present study, it appears reasonable to conclude that the most practical method of reducing fluctuations in the flow of the Klamath River is by the erection of a dam below Copco #2 hydro plant and development of potential power in the flow of the reregulated stream.

"The California-Oregon Power Company could be expected to install and operate the facilities provided:

- "a. That necessary permits and licenses be granted by state and federal agencies fully recognizing and protecting the company's existing rights in and to the use of the waters of the Klamath River for power generation.
- "b. That some public agency (Klamath River Fish and Game District is one possibility) contract with the company for regulation of the flow of the river in accordance with schedules of releases specified by the agency and assume any liability for damages to riparian owners below the regulating dam arising by reason of such changes in stream flow."

In the 1950's the Pacific Power and Light Company decided to construct Iron Gate Dam to produce power and to control in-stream flow fluctuations resulting from the operation of Copco power plants. Their decision responded in part to lawsuits concerned with the stranding of fish and the safety of fishermen and other recreationists. The Department of Fish and Game in response to Pacific Power and Light Company's application for water rights and a federal power license, filed a protest to the proposed adjustment of stream flows below Iron Gate Dam. The initial flow release recommendation made by the

Department of Fish and Game was negotiated with Pacific Power and Light Company resulting in a stream flow release agreement in 1958. The terms of this agreement were incorporated in Federal Power Commission license #2082 as a Protest Dismissal Clause. The Protest Dismissal Clause reads:

"Subject to conditions beyond its control, permittee shall release not less than the following amounts of water:

September 1 - April 30	1,300 cfs
May 1 - May 31	1,000 cfs
June 1 - July 31	710 cfs
August 1 - August 31	1,000 cfs

"Rate of change of flow shall not exceed 250 cfs per hour or change in river's level shall not exceed 3 inches per hour (measured not more than 0.5 mile downstream from Iron Gate development)."

A stipulation in Federal Power Commission license #2082 (June 5, 1962) required the construction and operation of a fish hatchery to mitigate the loss of anadromous fish habitat. The provisions of the stipulation dealing with the kinds and numbers of fish are as follows:

- "1. Fish hatchery facilities shall be sufficient to accommodate the incubation, hatching and rearing of the following sizes, kinds and numbers of fish each year:
  - "a. Steelhead trout (Salmo gairdnerii gairdnerii), rear 200,000 yearlings to a total weight not to exceed 20,000 pounds.
  - "b. Silver salmon (Oncorhynchus kisutch), rear 73,000 yearlings to a total weight not to exceed 5,000 pounds.
  - "c. King salmon (Oncorhynchus tshawytscha), rear 6,000,000 fingerlings to a total weight not to exceed 20,000 pounds and release an additional 5,500,000 swim-up fry.



The California Department of Fish and Game pays 20 percent of the hatchery maintenance costs.

#### IV. Post Project

Following the control of stream flow fluctuations, a great increase in the occurrence of rooted aquatic vegetation was noted in the Klamath River between Iron Gate Dam and the confluence of Shasta River. This vegetation reduced salmon spawning habitat through the increased settling of fines which compact the spawning gravels. Upstream dams have blocked gravel replenishment and reduced scouring flows required to clean existing spawning gravel.

In response to the anadromous fish habitat lost above Iron Gate and Copco, the Oregon State Game Commission, the Pacific Power and Light Company, the Bureau of Sport Fisheries and Wildlife, California Department of Fish and Game, Bureau of Commercial Fisheries, and local citizens cooperated in a 1964 and 1965 study to determine the feasibility of attempting to reestablish anadromous fish runs in the upper Klamath River basin. The scope of this 1964-65 study included compilation of historical information on the past fish spawning migrations and environmental conditions, a complete survey to determine the status of potential spawning areas, rearing areas and migration routes in the upper Klamath basin. Cost estimates were also made for construction of fish passage facilities. The findings and conclusions from this study were based upon the biological and physical data collected and the expertise of the agencies and individuals involved.

The following excerpt is the final conclusion and recommendations presented by a steering committee to the participants:

"While upstream migrations could conceivably be accommodated by fishways or trapping and transport facilities, there would be severe limitations on the ability to pass downstream migrants. Further, no stock of spring chinook salmon is available. Other major problems would involve water temperatures, residualism in the several large reservoirs enroute, predation by fish resident in these waters, losses through diversions for power and irrigation, and general failure of downstream migrants to negotiate these obstacles in sufficient numbers to perpetuate adequate runs.

"In view of the facts obtained and based upon the experience of the Committee members, we cannot recommend a program to re-establish runs of anadromous salmonids in the upper Klamath basin."

The State of California in order to protect certain rivers which possess extraordinary scenic, recreational, fishery or wildlife values, has provided special legislation entitled California Wild and Scenic Rivers Act to preserve these rivers for the benefit and enjoyment of the people of the state. The Klamath River below Iron Gate Dam and two of its major tributaries, the Trinity, Scott and Salmon Rivers, portions of which have been designated wild and scenic rivers (California Senate Bill 107) (Figure 3).

#### V. Conclusion

The construction of Iron Gate Dam did serve the planned purpose of reducing the diurnal and weekly fluctuations of streamflow that were produced at Copco power plant #2. The

Figure 3  
California Wild and Scenic River System  
(SB 107)



operation of the Iron Gate project did not significantly alter the annual seasonal distribution of streamflow from pre-project conditions, although the pre-project hydrograph displays a greatly reduced mean monthly flow regime due to the drought conditions during the 1930's (see Figure 3). Post-project mean monthly flows are greater than the streamflow reservations for fish and wildlife.

The data used to derive the minimum flow release schedule, which was primarily designed for king salmon, resulted from instream flow studies during the operation of Copco #2 and other general field studies (such as the Klamath River study, 1968).

The maintenance of anadromous fisheries resources in the Klamath River (primarily steelhead, silver salmon and king salmon) has generally been successful. Although there was some phreatophyte encroachment and sediment deposition during the initial post-project period, the streamflow releases at Iron Gate and the fish propagation facilities below the dam have maintained the salmon and steelhead runs in the Upper Klamath River. This is demonstrated by comparison of recent numbers of fish trapped at the hatchery (Department of Fish and Game, 1970 through 1975) and salmon counts taken at the Klamathon egg taking station. Since 1970 the following fish entered Iron Gate Hatchery (average annual run): king salmon, 8,720; silver salmon, 640 and steelhead, 2,300 (Gerstung, pers. comm.).

The terms of the FPC license issued for the Iron Gate project required the Pacific Power and Light Company to construct a hatchery to compensate for spawning and nursery areas blocked off and inundated by the project. A hatchery was considered the most acceptable alternative for mitigating this loss as compared to the alternative of fishway construction. The hatchery was constructed in 1962 and has been operated by the Department of Fish and Game (which pays 20 percent of the maintenance costs) since 1966 when it went into full operation. Overall, the hatchery has been a success; however, problems have recently developed with a reduction in the viability of the king salmon eggs raised in the hatchery (Coots, pers. comm.).

The Department of Fish and Game believes this reduction is due in part to an increase in the temperature of water being released from Iron Gate Dam which has resulted from an overall increase in water temperatures of the Upper Klamath River.

The USFWS and the Department of Fish and Game investigated the temperature problem and agreed that the problem exists in the hatchery, but salmon losses also could be a response to normal crowded conditions that occur in a hatchery. However, under natural stream conditions, no temperature problem could be found.

Local sportsmen had requested a cold water release from Iron Gate Dam, but due to the type of reservoir ("run of the river") and the high exchange rate of water in the reservoir,

a limited amount of cold water is available. As a result of the warmer water temperature and the introductions of warm-water fish into the river system prior to 1900, a warmwater fish fauna including yellow perch, brown bullhead, crappie, bass and sunfish is now well established in the Upper Klamath. Klamath River above Copco Dam is classified by California Department of Fish and Game as a wild trout stream and has an important resident rainbow trout fishery.

In response to the possible increase in water temperature, the State of California Permanent Fact Finding Committee on Natural Resources recommended that the "Department of Fish and Game monitor six temperature stations to determine if temperatures harmful to salmonids exist in the Klamath River below Iron Gate Dam".

#### BIBLIOGRAPHY

##### Personal Communications

Coots, Millard. 1975-1976. Associate Biologist, California Department of Fish and Game, Region I.

Healy, Terry. 1975-1976. Associate Biologist, California Department of Fish and Game, Region I.

##### References

California. Department of Fish and Game. 1967. California Oregon study Klamath River fish plans. News release for June, 1967.

----- . 1972-1975. Annual report Iron Gate salmon and steelhead hatchery for years 1971-1974. Anadromous Fisheries Branch Administrative Reports 74-3, 75-2, 72-11.

Miller, William E. and Jerry C. Tash. 1967. Interim report - Upper Klamath Lake studies, Oregon. Prepared for the Federal Water Pollution Control Administration. 37 pp.

Pacific Power and Light Company and Oregon Wildlife Commission. 1974. Review and analysis of Klamath River (Oregon) steelhead program. 21 pp.

Riley, James O. 1965. Klamath River salmon and steelhead management report for 1963-1964 fiscal year. 14 pp.

Snyder, John O. 1931. Salmon of the Klamath River. California Department of Fish and Game Fish Bulletin no. 34. 130 pp.

U. S. Bureau of Sport Fisheries and Wildlife. 1968. Fish and wildlife resources of the Klamath River drainage, Oregon and California, with brief comments relating to the Eel, Mad and Smith Rivers. 20 pp.

----- . 1969. Klamath Basin National Wildlife Refuge. Refuge Leaflet 68-R2. 4 pp.

U. S. Federal Power Commission. 1961. FPC order amending license no. 2082. 3 pp.

----- . 1962. Pacific Power and Light Company FPC no. 2082 decision upon petition by the State of California to require license to construct, operate and maintain a fish hatchery. 15 pp.

----- . 1962. Stipulation and agreement, California Department of Fish and Game and Pacific Power and Light Company for fish hatchery facilities.

U. S. Senate. Permanent Fact Finding Committee on Natural Resources. 1963. Second progress report to the Legislature - the Iron Gate Dam project - its effect on the Klamath River fishery. 71 pp.